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Detroit Edison

10CFR50.73

March 3, 1998
NRC-98-0020

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

References: Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

Subject: Licensee Event Report (LER) No. 98-001

Pursuant to 10CFR50.73, Detroit Edison is submitting the enclosed LER No. 98-001. This LER addresses an automatic reactor scram due to a main turbine trip caused by protective relay failure in the 345 kV switchyard.

The following commitment is being made in this letter:

- A long-term action plan will be developed by May 1, 1998 for the 345 kV switchyard that will provide assurance that configuration is maintained on the 345 kV switchyard and relaying house equipment.

If you have any questions, please contact Kimberly Harsley at (734) 586-1255.

Sincerely,

cc: A. B. Beach
B. L. Burgess
G. A. Harris
A. J. Kugler
M. V. Yudasz, Jr.
Region III
Wayne County Emergency Management Division

1141

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Fermi 2	0 5 0 0 0 3 4 1	1 OF 6

TITLE (4)
Automatic Reactor Scram due to Main Turbine Trip

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MON	DAY	YR	YR	SEQUENTIAL NUMBER	REVISION NUMBER	MON	DAY	YR	FACILITY NAMES	DOCKET NUMBER (S)
02	01	98	98	- 0 0 1 -	0 0	03	03	98		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (11)
	1	

POWER LEVEL (10)	
	9 6

X 10 CFR 50.73(a)(2)(iv)
OTHER -
(Specify in Abstract below and in text, NRC Form 366A)

LICENSEE CONTACT FOR THIS LER (12)

	TELEPHONE NUMBER	
	AREA CODE	
Kimberly N. Harsley - Compliance Engineer	734	586-1255

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	
B	S B	I S V	G 0 8 4			B	S B	I S V	G 0 8 4		
B	S B	F C V	G 0 8 4			B	F K	R L Y	A 5 0 0		

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
[ ] YES (If yes, complete EXPECTED SUBMISSION DATE)	[ ] NO				

ABSTRACT (16)

On February 1, 1998, the plant experienced a Reactor Protection System (RPS) actuation due to a Turbine Control Valve Fast Closure and the reactor scrammed at 0918 hours. The Turbine Control Valve Fast Closure was initiated when generator output breakers CM and CF opened resulting in a turbine load reject. The turbine load reject was initiated when the outside rounds Nuclear Power Plant Operator (NPPO) actuated the test reset switch for the Brownstown 3 "B" relaying panel in the 345 kV relay house. In addition to circuit breakers CM and CF, circuit breaker CT opened and Brownstown - Fermi 3 Line de-energized. The 345 kV buses remained energized through the DM and DF breakers, the redundant off-site power source. All control rods fully inserted into the core. Reactor Pressure Vessel (RPV) level decreased below the Level 3 setpoint resulting in a Nuclear Steam Supply Shutoff System (NSSSS) Group 4, 13, and 15 isolation signals.

Two degraded conditions existed on the Brownstown 3 "B" relay scheme. A circuit card was installed in the 50BF relay for the CM breaker in January 1997. The card that was installed in the relay had a latching resistor that should have been removed prior to installation. Secondly, an internal failure of the 95 (SRU) relay created and passed a voltage spike of sufficient amplitude and duration to pick up the breaker failure relay.

Corrective actions included replacement of the 50BF (SBFU) relay to eliminate the undesirable latching circuit and replacement of the 95 (SRU) relay to eliminate the stray high output signal.

Initial Plant Condition:

Operation Condition:	1 (Power Operation)
Reactor Power:	96 Percent
Reactor Pressure:	1022 psig
Reactor Temperature:	540 degrees Fahrenheit

Description of the Event

On February 1, 1998, at 0918 hours, the outside rounds Nuclear Power Plant Operator (NPPO) actuated the test reset switch for the Brownstown 3 "B" relaying panel in the 345 kV relay house. The test is part of a routine alarm functional test that is performed daily by operations. The plant experienced a reactor scram as a result of RPS actuation due to a Turbine Control Valve Fast Closure that was initiated when generator output circuit breakers CM [BKR] and CF [BKR] opened resulting in a turbine load reject. In addition to breakers CM [BKR] and CF [BKR], breaker CT [BKR] opened and Brownstown 3 line de-energized. The 345 kV buses remained energized through the DM and DF breakers, the redundant off-site power source. All control rods fully inserted into the core. The turbine bypass valves opened in response to the turbine trip and controlled reactor pressure. Reactor pressure peaked at 1080 psig and no Safety Relief Valves (SRV) lifted during the transient.

Reactor Pressure Vessel (RPV) level decreased to 119 inches. Post scram feedwater logic initiated and reactor feedpump speed decreased to approximately 2100 rpm. The Startup Level Control Valve (SULCV) shifted to automatic. The General Electric Transient Analysis Recorder System (GETARS) data showed the SULCV received an open signal and fully opened. RPV level did not increase until the South reactor feedpump was placed in manual and speed was increased by the operators in accordance with Abnormal Operating Procedure (AOP) 20.000.21. The SULCV modulated normally in response to the level increase and operators continued to maintain RPV level with the SULCV.

A reactor vessel low water level condition (Level 3) occurred as part of the event resulting in Nuclear Steam Supply Shutoff System (NSSSS) Group 4 (Residual Heat Removal Shutdown Cooling), 13 (Drywell Sump), and 15 (Traversing in-core probe system) isolation signals. Group 13 valves were the only valves open at the time of the scram and the valves isolated as required.

The reactor scram was reset at 0939 on February 1, 1998, and a four-hour notification of the reactor protection system actuation was made to the NRC pursuant to 10CFR50.72(b)(2)(ii)at 1230 hours.

Plant response and resultant reactor trip was normal with the exception of turbine response to the load rejection. An automatic turbine trip is initiated by the opening of the output breakers which is expected to limit turbine generator acceleration to approximately 110 percent speed. Actual speed reached was 124 percent. This overspeed is attributed to abnormally slow closure of #2 Low Pressure Stop Valve (LPSV) [ISV] and #2 Low Pressure Intercept Valve (LPIV) [FCV].

Cause of the Event:

The scram was initiated by the breaker failure relay 50BF (SBFU) [RLY]. A breaker failure circuit card was installed in the relay for the CM breaker. The breaker failure circuit card had a resistor in the circuit which caused the relay to be susceptible to actuation when exposed to a voltage spike of adequate duration. The card was installed in the CM breaker 50BF relay in January 1997.

Two degraded conditions existed on the Brownstown 3 "B" relay scheme. The first was the breaker failure relay 50BF, and the second was an internal failure of the 95 (SRU) [RLY] relay. Investigative testing revealed that when the test reset switch is operated, the alarm relay coils within the Type SRU [RLY] output relay is first energized, then de-energized, resulting in an inductive "kick" or surge voltage. The test reset switch produced a periodic transient voltage of sufficient magnitude and duration to generate an output on the breaker failure initiate board of the Type SRU [RLY] relay. This output by itself would not cause a breaker trip. The breaker failure initiate output of the Type SRU [RLY] relay satisfies one of two required inputs to the Type SBFU [RLY] breaker failure relay for position CM [BKR]. The other required input is a current level detector that picks up at 1200 primary amps, which was satisfied due to machine and line loading at the time. These two inputs would normally need to be present for 5.5 cycles (approximately 92 milliseconds) to produce a trip output and pick up the breaker failure trip string. However, because a modification had not been made to the Type SBFU [RLY] relay, an initiate signal of approximately 8 milliseconds in duration would be sufficient to produce a trip output. Had the modification to the 50BF [RLY] relay been completed, the voltage spike would not have been of sufficient duration (greater than 92 milliseconds) to have caused the trip regardless of the 95 (SRU) [RLY] relay equipment failure; therefore, the cause of the plant scram was the unmodified breaker failure relay 50BF circuit card installation.

The circuit card in the 50BF [RLY] relay for the CM [BKR] breaker should have been modified to remove the latching resistor prior to installation. Following the event, the circuit was visually inspected and it was verified that the installed card had not been modified as required. This card was installed in January 1997.

Maintenance activities on protective relaying equipment in the 345 kV [FK] and 120 kV [FK] switchyards are performed by Corporate Equipment Performance and Predictive Maintenance (EPPM) personnel under a Fermi work request. Fermi maintains oversight of EPPM personnel. Material control, maintenance and configuration control for relaying equipment in the switchyards are performed by Corporate EPPM. An interim work control process has been developed that will provide assurance that configuration will be maintained on the relaying equipment until a long-term action plan is developed.

Analysis of the Event:

The Main Turbine Generator (MTG) [TG] tripped while operating at 96 percent power as a result of the turbine load reject. An evaluation of the event to determine the cause of the overspeed was performed and it was concluded that the #2 LPIV [FCV] and #2 LPSV [ISV] did not close in the proper time to prevent the main turbine speed from reaching 2234 rpm (124 percent).

Under normal conditions, the fast valve closure mode initiates the closure of the High Pressure (HP) Turbine Stop Valves (TSVs), High Pressure Turbine Control Valves (TCVs) and the LPSV and LPIV valves. The HP valves are designed to close in less that 220 milliseconds and the Low Pressure (LP) valves in less than one second. The LP valve closure time allows the energy in the HP turbine and Moisture Separator Reheaters (MSRs) to be bled off in such a fashion as to not add to the overspeed of the coupled rotor train. Even with the unit valves functioning normally the rotor may accelerate between 7 and 10 percent following trip initiation.

Following the turbine load reject, turbine speed increased abnormally. Both the electrical and mechanical overspeed trip devices initiated. All of the HPCV and HPSV valves closed as designed; however, the Sequence of Events Recorder (SOER) indicated that the #2 LPIV [FCV] and #2 LPSV [ISV] did not close within their specified time.

Investigation into the Main Turbine 124 percent overspeed revealed that the #2 LPIV [FCV] and #2 LPSV [ISV] valves did not close in the proper time to prevent main turbine speed from reaching 2234 rpm. The most probable cause of the valves sluggish response is increased friction, binding, of the roller bearings. The #2 LPIV [FCV] binding of the roller bearings was most likely due to corrosion causing the valve not to function properly. Subsequent lubrication of the roller bearings and repeated successful stroke time testing provides confidence that the #2 LPIV [FCV] will perform its intended function during a main turbine trip.

The #2 LPSV [ISV] had two problems that contributed to the valve's sluggish response, increased friction, most likely due to corrosion, of the roller bearings and the unitized actuator dump valve being out of adjustment. Lubrication of the roller bearings and adjustment to the dump valve were required to assure proper valve operation.

Additional testing of the remaining ten LP valves indicated that the #1 LPSV [ISV] had not closed in the required time. The unitized actuator dump valve was readjusted and was stroke tested with an acceptable time. In addition to the valve stroke times being verified for each LP valve to close in less than one second, roller bearings were lubricated on all 12 LPIV and LPSV valves.

The investigation into the LP valve failures concluded that exercising the valves more frequently should prevent valve binding reoccurrence. The frequency of LP valve testing was increased from quarterly to bi-weekly and LP valve performance and vendor recommendations will be used to determine valve testing frequencies for the remainder of this cycle and future cycles.

An evaluation team, which included the System Engineering Organization, Engineering Support Organization, and the turbine generator manufacturers, General Electric and GEC - Alsthom, was assembled to evaluate the turbine event. The evaluation included an analysis of the generator rotor retaining rings to determine the stress levels at 124 percent. The calculations performed on the retaining rings concluded that the yield strength for the retaining rings was 108 ksi, which was well below the GEC design limit of 145 ksi. A rotor train vibration profile was diagnosed before and during the turbine trip and the analysis revealed no mechanical damage to the rotor train. Even at turbine speeds from 218 to 222 percent the design strength of the LP turbine blades would not be exceeded. Based on this evaluation, it was concluded that no damage to the rotor train occurred due to the opening of the CM [BRK] and CF [BKR] breakers and the HP turbine and LP turbines and generator components were not affected by the 124 percent overspeed.

No additional abnormalities to the plant scram response were noted and Emergency Operating Procedures (EOPs) and Abnormal Operating Procedures (AOPs) were implemented with no noted problems or identified areas for procedural improvement.

Corrective Actions:

Corrective actions included the replacement of the 50BF (SBFU) relay to eliminate the latching resistor, and replacement of the 95 (SRU) relay to eliminate the stray high output signal. Plant walk-down verification on the 345 kV relaying equipment that required modification prior to installation was also performed. Components that were identified to have incorrect configurations were corrected prior to restart on February 14, 1998.

The interim work control process for all work associated with the 345 kV switchyard and relay house will be conducted under control of Fermi Maintenance Supervision with support by Corporate Energy Marketing and Distribution (EM&D), the Engineering Support Organization, and System Projects and Engineering Supervision during work planning, execution, testing, and paperwork close-out. Parts installed in these systems will have the responsible EM&D organization provide written verification of their applicability for configuration control with a review of the written verification by Fermi's Plant Support Engineering. This interim work control process will remain in effect until a long term corrective action plan is developed. A long-term action plan will be developed by May 1, 1998 for the 345 kV switchyard that will provide assurance that configuration is maintained on the 345 kV switchyard and relaying house equipment.

The frequency of LP valve testing was increased from quarterly to bi-weekly and LP valve performance and vendor recommendations will be used to determine valve testing frequencies for the remainder of this cycle and future cycles.

Additional Information:

A. Failed Components

Component: #2 Low Pressure Stop Valve (N3021-F012B)
Description: Isolation Valve
Manufacturer: GEC Alsthom
Type Number: Style 7

Component: #2 Low Pressure Intercept Valve (N3021-F013B)
Description: Flow Control Valve
Manufacturer: GEC Alsthom
Type Number: Style 6

Component: #1 Low Pressure Stop Valve (N3021-F012A)
Description: Isolation Valve
Manufacturer: GEC Alsthom
Type Number: Style 7

Component: 95 (SRU) Relay
Description: Tripping relay
Manufacturer: ABB
Style Number: 205C260A17

B. Previous LERs on Similar Problems

None

CATEGORY 1

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HARSLEY,K.N. Detroit Edison Co.
GIPSON,D.R. Detroit Edison Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 98-001-00:on 980201,automatic reactor scram occurred due to main turbine trip.Caused by protective relay failure in 345 kV switchyard.Circuit card was installed in 50BF relay for CM breaker in Jan 1997.W/980303 ltr.

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